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UNIVERSITY OF MINNESOTA
CENTER FOR URBAN AND REGIONAL AFFAIRS

PROGRAM IN URBAN TRANSPORTATION
PROGRESS REPORT FOR PERIOD JANUARY 1, 1970 TO MARCH 31, 1970

Submitted to
U. S. Department of Transportation

INTRODUCTION

This document constitutes a report of Progress on Project No. MINN-R11-31-69/URT-14, Contrct No. H-1116 for the period January 1 to March 31, 1970.

GENERAL NOTES

New Research Assistants

The following new research assistants have been appointed:

Thomas Balcomb, a first year graduate student in Geography, has been appointed research assistant to Professor M. J. Huber in the Department of Civil Engineering to work on Project C.E. 1.

Miss Ann Noble, a graduate student in the School of Library Science, has been appointed for research assistant to work with Mrs. Margaret Wolfe in the cataloging of Urban Transportation literature (stationed in the Civil Engineering Department).

Another research assistant not previously reported is Mr. K. K. Burkhardt, a Ph.D. student in Electrical Engineering, who is working with Professor K.S.T. Kumar on Project EE 1.

This brings the total number of research assistants supported under this program to 11. (There are in addition 6 fellows.)

Interdepartmental Inter-actions

Mr. Francis P. D. Navin, now an Urban Transportation Fellow majoring in Civil Engineering, has been invited to serve next year as a teaching assistant in the school of Architecture to assist Professor Hosni Iskander in teaching planning courses.

Attention is called to the interdisciplinary nature of the new research assistants mentioned above:

Mr. Balcomb, a geography student, working in Civil Engineering.
Miss Noble, a library student, working in Civil Engineering.
Several faculty members originally brought together by the Program in Urban Transportation are now serving on various interdisciplinary committees. For instance Dr. D. L. Gerlough of Civil Engineering is serving on a committee of the College of Liberal Arts to develop a major in Urban Studies.

Law School Participation

It is expected that two faculty members of the Law School will begin active participation in the Program in Urban Transportation in the near future. The following are brief vita of these men.

Ferdinand Schoettle
AB Princeton 1955
LLB Harvard 1960
Law Clerk, Judge Larned Hand, 1960 - 61
Office of Tax Legislation Council, U.W. Treasury Dept., 1961
Assistant to Senator Joseph S. Clark, 1962 - 1964
Associate work in Lewis, Morgan & Bockius, 1963 - 1967
Associate Professor of Law, U of Minnesota, 1967 - present

Glen Robinson
AB Harvard 1958
LLB Stanford 1961
Note Editor, Stanford University Law Review
Associate, Cavet & Burlingford - Washington, D. C. 1961 - 1967
Associate Professor of Law, U of Minnesota - 1967

TRAINING

Seminar in Urban Transportation

The interdisciplinary Seminar in Urban Transportation continues to serve as a principal medium for interdepartmental participation. Exhibit 1 lists the speakers and topics during the quarter. Exhibit 2 summarizes the attendance.

Progress of Fellows

Mr. Richard Meyer expects to complete his M.A. degree in June, 1970.

Mr. Henry Peyrebrune expects to complete his course work and preliminary examinations for the Ph.D. by the end of August, 1970. He will then return to his position with the New York State Department of Transportation. He will conduct his dissertation research in absentia using New York State data.

Mr. Francis Navin expects to continue his studies next year. (See note above in section on Interdepartmental Interactions.)

Mr. T. M. Aydinalp expects to complete his course work and preliminary examinations for the Ph.D. before the start of the Fall Quarter, and will conduct his dissertation research during the 1970-1971 academic year.

Mr. Gary Lamont, and Mr. Robert Tomisak who hold a dissertation fellowships, will complete their Ph.D. work this June.

Interdisciplinary Design Course

The three student projects described in the previous progress report are underway and on schedule. The final reports are due at the end of the Spring Quarter.

EXHIBIT 1.

SEMINARS HELD JANUARY 1 TO March 31, 1970

Jan. 6 Design of Pedestrian Facilities

Mr. F. P. D. Navin, Urban Transportation Fellow
University of Minnesota

Jan. 20 Control and Estimation Problems in Vehicular Traffic

Dr. K. S. P. Kumar, Assoc. Prof. of Elect. Engrg.
Mr. G. B. Lamont, Urban Transportation Fellow
University of Minnesota

Jan. 27 Recent Urban Transportation Research in Great Britian

Mr. T. M. Coburn
Road Research Laboratory
Ministry of Transport, U. K.

Feb. 3 New Transportation Technologies

Dr. J. E. Anderson, Assoc. Prof. of Mech Engrg.
University of Minnesota

Feb. 10 Vertical Urban Transportation: Elevators for the World's Tallest Buildings

Mr. James J. Browne
Port of New York Authority

Feb. 17 The Design Team Concept

Mr. Milton Pikarsky
Commissioner of Public Works
City of Chicago

Feb. 24 Transit for the Twin Cities

Mr. Thomas B. Deen
Alan M. Voorhees and Associates, Inc.

Mar. 3 Models of Transportation and Land Use

Mr. Morton Schneider
Creighton, Hamburg, Inc.

Mar. 10 Congestion and the Near-Far Problem in Airport Pricing

Mr. James Likens
Pomona College
(Formerly Research Assistant
Program in Urban Transportation
University of Minnesota)

Mar. 31 A Multiple Station Interaction Point Queueing Model

Dr. D. A. Frohrib, Assoc. Prof. of Mech. Engrg.
Mr. Robert Tomisak, Urban Transportation Fellow
University of Minnesota

EXHIBIT 2. SEMINAR ATTENDANCE - JANUARY -- MARCH, 1970

	January			February				March			Total
	6	20	27	3	10	17	24	3	10	31	
Graduate Students	11	12	22	15	11	12	15	10	12	14	134
Faculty-Staff	5	7	6	6	7	8	13	8	5	6	71
Minnesota Highway Department		2	6	3	4	4	3	5	3	1	31
U.S. Gov't Bureau of Public Roads		1	2			2	2	2			9
Honeywell			1	1	1	1	2				6
Undergraduate Students						3	4	1			8
3M Company							1				1
Residence Assistant							2		1		3
Consultant								2	1		3
Metropolitan Transit								2			2
Total	16	22	37	25	23	30	42	30	22	21	268

RESEARCH

Progress during the quarter is reported by projects as follows:

PROJECT CE 1: FORECASTING DEMAND FOR TRANSPORTATION AND THE RELATIONSHIP TO THE DESIGN OF TRANSPORTATION FACILITIES (Principal Investigator: M. J. Huber)

A research assistant was employed on a part-time basis effective March 23, 1970. (The research assistant is also a recently admitted candidate for the M.A. degree (geography) with a study program developed under the sponsorship of the Program in Urban Transportation.

Continued testing and evaluation of regression models used to forecast the volume of inter-urban travel at a given urban area as a function of a) population b) highway volume characteristics and c) measure of economic activity.

Continued evaluation of accessibility of each urban area (over 5000 population) in Minnesota to all other urban areas in the state. Cumulative plots of the total population encompassed at successively increasing distances from each urban area are being prepared. These values are to be used in testing the applicability of the "Intervening Opportunity" Model to the distribution of inter-urban travel.

PROJECT Econ 1: LOCATION - TRANSPORTATION INTERACTIONS AND THE MODAL SPLIT PROBLEM (Principal Investigator: H. Mohring)

At the time the July - Sept. 1969 report was written, developing a behavioral model that is both reasonably realistic and capable of being tested with the Survey Research Center data at our disposal had proven to be more difficult than we had anticipated. By the end of the summer, what promises to be a workable model had been developed and a preliminary discussion of this model had been written. The work remaining involves (1) further processing of the raw data, e.g., to code information in a form suitable for regression analysis and to eliminate observations on households that regard their current locations as being unsatisfactory; (2) statistical analysis of the purified data, and (3) writing up the results of the statistical analysis. The research assistant doing this study, Thomas Pinfold, has assumed a full time teaching appointment. He spent more than full time during the fall and winter quarters preparing for classes. As a result, there is no further progress to report. This study will probably not be completed until summer 1970.

PROJECT Econ 2: OPTIMAL UTILIZATION OF AIRPORTS: CONGESTION PRICING AND THE "NEAR-FAR" PROBLEM (Principal Investigator: H. Mohring)

The theoretical issues involved in incorporating congestion costs into airport pricing policies has been thoroughly explored, relationships between the delays experienced and the volume of commercial and private aircraft landings and take-offs at Washington National, Dulles, and Friendship airports have been determined, and alternative procedures for estimating the cost savings that would result under simplified assumptions from applying congestion tolls to the operations of these airports have been developed and applied. The basic conclusion reached is that an appropriate toll structure would reduce by about $20 million a year the cost of airline and passenger-supplied inputs for trips to the Washington area from their present level of about $100 million a year. Perhaps not surprisingly, application of appropriate congestion tolls to the use of Washington National Airport would result in its being virtually abandoned by private aircraft. A preliminary version of the final report on this study is presently available.* The final version is being typed and should be available by April 30.

* One draft copy submitted with this report

PROJECT Econ 3: THE VALUE OF TRAVEL TIME IN URBAN TRANSPORTATION STUDIES (Principal Investigator: H. Mohring)

As with Econ 1, developing a realistic, testable model proved to be more difficult than had been anticipated. A promising model was developed and applied to a hypothetical city of a sort described in [1]. This analysis suggests that biases are, in fact, involved in using a model of the sort employed in [2] to infer the values households place on travel time. The results of this analysis have been checked and summarized. The Survey Research Center data involved in this study have been put into a form suitable for analysis. Analysis is now in progress. A preliminary report on this study should be available in the very near future.

PROJECT Econ 4: QUANTIFICATION OF ECONOMIC JUSTIFICATIONS FOR URBAN MASS TRANSIT SUBSIDIES (Principal Investigator: H. Mohring)

Unanticipated problems in completing the empirical analysis described in the third section of [3] seem to arise continually. At the time the first progress report was written, it seemed that if no further problems arise, a final report on this analysis should be available by the end of February.

Further problems did arise. May 31 now seems like a realistic date for completion. Models of use in determining optimum stop spacings and bus service frequencies under varying demand conditions have been developed and have been programmed for computer processing. Results are currently being written up and will be presented at the Seminar in Urban Transportation April 14. Results of part of this research have tentatively been accepted for publication in the American Economic Review. Related models are now being developed dealing with the optimum spacing between routes and with the choices consumers will make between mass transit and private passenger vehicle travel given varying mass transit service characteristics.

[1] "Urban Transportation Improvements and the Spatial Distribution of Land Values," presented at the Seventh Annual Conference, Committee on Taxation, Resources and Economic Development.

[2] "Land Values and the Measurement of Highway Benefits," Journal of Political Economy, June 1961.

[3] "Peak-Loads, Increasing Returns, and The Welfare Costs of Non-Optimal Pricing and Investment Policies," presented at the Econometric Society Meetings, December 1968.

PROJECT EE 1: THEORETICAL STUDIES OF MASS TRANSIT SYSTEMS
(Principal Investigator: K.S.P. Kumar)

Mr. Gary B. Lamont is completing his dissertation on estimation theory for distributed parameter systems. The results have been applied to estimate traffic flow along a roadway. These are being readied for publication. One paper has been accepted for conference presentation.

Mr. K. K. Burhardt, a research assistant, is conducting studies to formulate a general model for a traffic network consisting of many oversaturated 1-way and 2-way intersections and to determine necessary and sufficient conditions of optimality for traffic signal switching strategies. The results have been readied for publication.

Preliminary work on the command and control problem for a complete controlled traffic system had been initiated. The results so far have given indications as to the parameters that are to be monitered by the computer. Detailed work in this area is under progress.

PROJECT Geog. 1: FORECASTING AREAL DEMAND FOR SUBURBAN MASS TRANSPORTATION FACILITIES IN THE TWIN CITIES METROPOLITAN AREA (TCMA) (Principal Investigator: R. B. Adams)

At the end of the last quarter contact was made with several public agencies to work out ways of handling problems of mutual interest regarding plans for a mass transit system in the Twin Cities. The Planning Division of Minnesota Highway Department was very helpful: in January 1970 we obtained copies of forty-one maps produced by the Planning Division which described in detail various projections for transit traffic generation, population, and settlement for the year 1985 ("System 14 Assignment"). The project research assistant, Gregory Stein, compiled a list of these maps which will be used to extract the data for application and analysis in the final project report.

The Historical Investigation by Mr. Stein has moved ahead along several lines. Maps of traffic flow from the Lake Minnetonka area to the Twin Cities are being reproduced for this study by the Hennepin County Highway Department; several origin-destination studies are already in use. Plans have been made for the reproduction of highway maps for early periods in this sector.

A 2000-item bibliography of Transportation Geography, which includes recent transit literature, was prepared during the past quarter.

PROJECT ME 1: A STUDY OF INTERACTION POINTS COUPLING TRANSPORTATION SYSTEMS (Principal Investigator: D. A. Frohrib)

Our most recent progress report (January 5, 1970) indicated that a search for a method of approximating 2^n-1 simultaneous difference equations by some lesser number was then in progress. We now have a method of approximating 2^n-1 equations by n equations, and thereby greatly reduce the computational effort required to solve higher order cases (large n, where n is the number of calling units, vehicles, in a series loading/unloading arrangement).

Work has also been done to verify the validity of our approximations. For example, it is shown that results for maximum utilization (arrival rate/service rate) remain unchanged, and that certain other measures of performance, say, expected number of units in the queue, are in close agreement with those in the exact solution.

With the ability to solve the general N stage problem, we are now considering queue disciplines to employ in multiple channel models, and the closely related optimization problem.

PROJECT ME 2: OPERATIONAL CHARACTERISTICS OF MASS TRANSIT SYSTEMS (Principal Investigator: J. E. Anderson)

The hybrid computer simulation of the interaction between personalized transit vehicles has continued. The first phase in which an air suspended and propelled vehicle has been simulated is complete and a report is being written. The result give requirements which must be met to avoid collisions.

A paper entitled "Personalized Transit for the Twin Cities" has been written and a copy is transmitted herewith.

BUDGET SUMMARY - PROGRAM IN URBAN TRANSPORTATION

CONTRACT H-1116 -- U. S. DEPARTMENT OF TRANSPORTATION

CATEGORY	ALLOTMENT	EXPENDITURES THRU 3/31/70	ESTIMATED COST THRU 6/30/70	ESTIMATED BALANCE 7/1/70
Fellowships	$49,100.00	$46,300.00	$ ---	$2,800.00
Training	38,767.00	16,521.37	18,260.19	3,985.44
Research	62,133.00	32,573.81	25,795.81	3,763.38
TOTALS	$150,000.00	$95,395.18	$44,056.00	$10,548.82